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Addictive goods and taxes: A survey from an economic perspective

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Abstract

In this paper we present an overview of the empirical evidence about the effectiveness of using taxation to influence addictive behaviour, and we address the normative question: should greater use be made of sin taxes to fund health care? First, we raise the desirability of linking health care financing and taxation of addictive goods, taking into account efficiency and equity principles. Secondly we present the approaches adopted by economists in the study of addiction and their policy implications. At the end, the empirical evidence of effectiveness of taxes is summarised.

Keywords: Addiction, tobacco, alcohol, sin taxes

JEL classification: I18, H21, H23, H51.

1. Introduction

One of the justifications for «sin taxes» on goods, such as alcohol and tobacco, is the belief that consumers hold «inconsistent» preferences for these goods, and that governments have a role to protect consumers from themselves by trying to discourage consumption. Alcohol and tobacco not only generate adverse effects on those who drink and smoke, but also on those who do not, these are known as «externalities». This provides a rationale for government intervention in the market [1] —by increasing the price of those goods that could damage other people— so that the level of demand will be reduced. Harmful addictive goods pose a risk to health, which is regarded as a merit good. From the perspective of categorical equity objectives, taxing harmful goods could help in improving health, and this could be partly financed using the revenue obtained from excise taxes. But are these normative ideals the true reasons for taxing tobacco and alcohol? It is well known that excise taxes generate extra revenue for governments. The causality is not completely clear; are these goods taxed in order to protect consumers, or are they chosen as taxable goods since consumers cannot protect themselves (because their addictive patterns of behaviour limit their ability to re-

spond to the price increase)? In this paper we present an overview of the empirical evidence about the effectiveness of using taxation to influence addictive behaviour, and we address the normative question: should greater use be made of sin taxes to fund health care? The use of sin taxes as a potential source of funding health care has the main advantage of transparency, but is not without drawbacks especially if we want progressive taxes. On the other hand, if people consume less harmful goods, the impact on health care funding could be a problem when taxes are earmarked.

The document is organised as follows. Section 2 deals with normative issues, presenting the most important principles to consider when implementing public policies of taxation and expenditure-efficiency and equity. These principles have to be considered when deciding if it is desirable to link health care financing and taxation of addictive goods. Section 3 presents the approaches adopted by economists in the study of addiction and their policy implications. The empirical evidence on effectiveness of taxes is summarised in section 4, and finally, a brief discussion closes the paper in section 5.

2. Normative issues

Consumption of the addictive goods that are being considered here —alcohol and tobacco— generates a direct effect on the health of consumers. Should the revenue obtained from taxes on addictive goods therefore be linked to the funding of health care? As it stands this question is rather general. To focus the issue and highlight the trade-offs involved it is helpful to be more specific and to ask questions about the funding of existing levels of health care provision and about incremental expenditure:

- Should all or part of the current funding sources for health care —whether they be general tax revenue, social insurance contributions, private insurance premia or direct payments— be replaced by revenue from «sin taxes» on addictive goods like alcohol and tobacco?
- Should an expansion of health care provision be funded by additional sin taxes rather than through other sources of funding?

Government policies can be judged by some essential principles, and economists emphasise the role of efficiency and of equity. The existence of a trade-off between these two objectives is well known, and it should be taken into account when obtaining resources (taxation of addictive goods) and in the allocation of expenditure (health care). After presenting these normative issues it will be easier to think about the question posed above.

2.1. Objectives for health care financing

We do not try to discuss how the *general* organisation of health care provision and funding should be designed to achieve efficiency and equity principles. Instead we focus on the matter of how taxation of addictive goods and health care financing could be connected.

When public sector activities are viewed as a whole, there are different sources of revenue that allow for different expenditures but, in principle, one tax is not specifically designed to cover a specific expense. However it is possible to think in terms of an explicit linkage, giving what is known as «hypothecated» or «earmarked» taxes. This is not a new idea, but there has been some resurgence of interest in their use for health funding (see e.g., Jones and Duncan, 1995, for a critical appraisal of proposals).

Some examples of recent proposals can be found for the EU. The European Alcohol Action Plan (EAAP) proposed several actions for the EU, and one of them is «to use alcohol taxes to fund alcohol control activities, including health, education, research into alcohol policy and support to health services» [Allebeck (2001)]. In the United Kingdom, the government decided in 1999 to earmark tobacco duty for preventing and treating smoking related diseases. Dr. Ian Bogle, chairman of the BMA council pointed out that the tax would not solve the NHS's pressing financial problems, but the priority must be to persuade young people not to smoke and help smokers to stop [Beecham (1999)]. The Spanish government approved last year a retail tax on certain hydrocarbons whose revenue is earmarked for health and environmental public expenditure [2]. This decision was an internal one, not concerning all EU countries, since there exists fundamental legal constraints that can inhibit a supranational approach. This is one drawback —pointed out by Collin and Gilmore (2002)— in the intergovernmental negotiations on a Framework Convention on Tobacco Control (FCTC) held in Geneva in October 2002. Most tobacco related laws have been enacted as internal market measures because there is a legal subordination of public health to the harmonization of the single market in the European treaties. As these authors stated «... developing a shared position... produces the lowest common denominator position, particularly when the most reluctant participant is also one of the most powerful».

Even though efficiency and equity are not the only matters of concern in the analysis of public policies (for example, simplicity and sufficiency are also relevant principles [3]), only these two will be described, because we consider they are the most relevant in the economic analysis of health care financing.

2.1.1. *Efficiency*

In the context of public intervention, the achievement of efficiency refers to the fact that, when governments operate in the economic system, they can alter the price of goods and services. If consumers would have chosen certain amounts of goods and services according to the existing prices prior to the intervention, this will result in a cost due to the «distortion» of their decisions. Not all the tax measures alter prices in the same way, nor in the same quantity. So, there are —for the same goal to be achieved— some measures that are more efficient than others.

Assuming that the health system is funded from general revenue obtained from the tax system (a common approach in many developed countries that operate national health services), a total or partial replacement of the funding by a hypothecated tax, leads

to three main questions. First, what is the impact of the new tax on economic behaviour, and to what extent will it create a distortion and reallocation of resources? If the health tax is to be built around tobacco and alcohol consumption, what will be the effect on buyers and sellers, the levels of consumption and of prices? One could be tempted to think that the distortions generated on those who consume addictive goods are worthy. But is not so easy to draw this conclusion, as will be explained later. Also, a tax does not generate effects exclusively on tax-payers. Second, the method of funding could be relevant to the achievement of an optimal level of funding for health care. If the tax-bases are not broad enough, or do not provide enough revenue, it will constrain the level of expenditure in health care. It is also interesting to consider if the method of funding has a role to play in determining what level of spending should be devoted to health care compared to other expenditure policies. Third, the method of funding could influence the efficient allocation of resources within the health care sector. Following the example in Jones and Duncan (1995), a move from a retrospective reimbursement system such as fee for service to a prospective reimbursement system such as preferred providers and capitation payment of global budgets may affect cost containment. We are concerned now with the implications of a move from general taxation to earmarked taxes, an the issue seems to come down to two things; whether the new system implies a move to an open-ended demand-led system and, whether it implies a change in management structures (and the autonomy of the health care sector).

2.1.2. *Equity*

When considering notions of fairness in health care, there are two questions that should be analysed: how to achieve equity in obtaining the resources for health care funding, and how to achieve equity in the expenditure of these resources. Equity is a notoriously difficult concept to define, due to its inherent subjectivity. For some, equity means giving the same to everybody, for others, it means giving each what they deserve. Van Doorslaer *et al.* (1993) review concepts of equity that are embodied in health care systems across the OECD countries. Their findings suggest that the most widely held values are that contributions to health care finance should be based on ability to pay, and that the delivery of health care should be based on need, irrespective of an individual's ability to pay.

If the financing of health care is based on ability to pay, a proportional or progressive system tax will often be regarded as equitable. Proportionality means that everyone pays the same share of their income for health care. Progressivity means that those with greater income (the usual measure of ability to pay) will contribute proportionately more to the tax revenue. Not only more in absolute terms, but in relative terms: the ratio of tax to income must be greater for those who are better-off compared with the worse-off.

2.2. Objectives for taxing addictive goods

As in the study of health care, efficiency and equity are basic principles to include in the analysis of the taxation of addictive goods.

2.2.1. *Deadweight loss*

If a tax is levied on a good, say excise taxes on alcohol or tobacco, it could affect the decision of how much to consume and generate an efficiency cost. The nature of this efficiency cost depends on whether the tax is passed to consumer price, and the responsiveness of the consumer to changes in price [4] (see e.g., Jones and Posnett, 1988). Given a non-zero estimated demand elasticity (that is, consumers respond when price changes), an increase in the excise tax would lead to an efficiency cost.

When a price increases due to a new or higher tax, there are two relevant effects in the measure of the efficiency cost: an income effect and a substitution effect [5]. The income effect, that measures the impact of the reduction in real income generated by a tax, is unavoidable, and there is always this cost if the tax revenue is non-zero. But in addition to this cost, there is another one known as the excess burden, or deadweight loss, which depends directly on the tax rate and on the responsiveness of consumers. This second cost is a measure of the substitution effect, which leads consumers to rearrange their decisions when the tax changes relative prices. Consumers would try to substitute away from the taxed good, whose price is relatively higher, and this change generates the efficiency cost. This is called an excess burden because, in principle, it could be avoided using tax instruments that do not change relative prices. For example, Jones and Posnett (1988) estimated that the excise tax on cigarettes in Britain in the 1980s generated an excess of burden of 17 % of the revenue raised. This should be interpreted as one extra pound of revenue generates a burden to the consumer of 1.17 pounds.

2.2.2. *Social costs and externalities*

Consumption of addictive goods, such as alcohol and tobacco, has adverse consequences that affect not only the consumer, but other agents, these are known as «externalities». An externality occurs when one of the costs or benefits which result from production or consumption is not taken into account by producers or consumers. In an ideal system, efficiency is achieved when goods that are worth more than they cost to consume/produce get consumed/produced, and goods worth less than they cost, do not. There are two conventional solutions to correct externalities, one is direct regulation that restricts how much consumption or production is allowed, the other is to discourage the activity that causes the external effect by a tax, that usually is known as «Pigouvian tax». However, Coase (1960) argued that, as long as the parties involved can readily make and enforce contracts in their mutual interest, then neither the direct regulation nor taxes are necessary in order to achieve efficiency [6]. Only a clear definition of who has a right to do what is necessary, and the market will take care of the problem.

In the absence of government action, prices will be «too low» in the sense that, at the margin, the value of alcohol or tobacco for consumers will be less than their costs. Taxes on alcohol and tobacco can be justified as a mechanism for internalising the external costs derived from their consumption. In an ideal world, the taxes should equal the expected value of the social cost of consumption. There is a fundamental difference between the Pigouvian principle, based on an efficiency argument, and the equity principle that «those who consume drink or smoke should pay». The efficiency principle, unlike the fairness principle, requires that corrective taxation alters consumers' behaviour. If an increase in the price of alcohol or tobacco due to a tax had no effect on the demand and its external consequences, then it would not improve efficiency.

Social costs generated by the consumption of addictive goods differ with circumstances, however, excise taxes do not discriminate with respect to correlates of alcohol and tobacco related problems. Cook and Moore (2000) present an example where non-uniformity would achieve the policy objective. They point out that «a 21-year-old man who drinks seven beers a week in a single session and then attempts to drive home pays the same tax as a 40-year-old woman who drinks one beer with dinner each night». Obviously, the danger generated driving home after having drunk seven beers is what an excise tax on beer should try to avoid. But the 40-year-old women will pay the same tax than the young man and she is not causing any externality. If the excise tax is viewed as an instrument to discourage the harmful consumption related problems, it should be paid only when there is a risk. This would lead to a discrimination in tax rates according to the age of consumers, the place where the product is consumed, the amount consumed per time unit or other circumstances. In general, the transactions costs associated with levying excise taxes would make this kind of discrimination hard to implement in practice.

Cigarette smoking has been associated with lung cancer, chronic bronchitis and emphysema, heart disease and stroke, aneurysms, atheroesclerotic peripheral vascular and other diseases, intrauterine growth retardation and neonatal death, including SIDS, vision and hearing problems, increased susceptibility to certain infections (see Chaloupka and Warner, 2000). Risk beliefs are not always consistent with reality. Antoñanzas *et al.* (2000a) conclude that risk beliefs are particularly high for younger respondents in Spain, but are lower for better educated respondents. Chronic inhalation of environmental tobacco smoking (ETS) is linked to lung cancer in non-smokers and functional limitations in the children of smokers (Chaloupka and Warner, 2000). Primary smoking risks have a more consistent negative effect on smoking than perceived passive smoking risk, as stated Antoñanzas *et al.* (2000b) using Spanish data. The costs to society associated with these health risks are often classified in three categories (see Chaloupka and Warner, 2000):

- Direct medical costs of preventing, diagnosing, and treating smoking related diseases;
- The indirect morbidity costs associated with lost earnings from work attributable to smoking;
- The indirect mortality costs related to the loss of future earnings due to premature smoking-produced deaths.

Some authors have also calculated the economic «benefits» of smoking, including the reduction in Social Security payments for smokers who die prematurely [see for instance, Leu and Schaub (1983), Manning *et al.* (1989), Shoven *et al.* (1989), Hodgson (1992), Viscusi (1995), Barendregt and Olekaln (1998), Warner *et al.* (1999)].

From this cost of illness perspective smokers are viewed as imposing an economic burden on society and it sometimes argued that they ought to pay for it through higher excise taxes. Economists have countered that for purposes of estimating an optimal cigarette excise tax, the correct notion of social cost is the traditional measure of externalities (costs imposed by smokers on others, excluding their own family members). Given the strength of the evidence linking price increases with decreases of demand, with the consensus that the price elasticity is inversely related to age, cigarette tax increases are often seen as one of the most effective policy tools for decreasing smoking, especially among children (see e.g., Lewit and Coate (1982), Grossman *et al.* (1983), Baltagi and Goel (1987), Barnett *et al.* (1995), Hu *et al.* (1995), Keeler *et al.* (1996), Cicca De *et al.* (1998), Evans and Farrelly (1998) and Chaloupka and Warner (2000) for an overview). In addition, the health benefits of a tax increase could justify its imposition since the effects of diminishing smoking generate savings in health care expenditure. However, there are some conceptual and empirical problems in the construction of measures of social cost of smoking. In the definition of social cost, some analysts include both negative externalities and private costs, while economists agree that private costs should not be considered in contemplating a corrective tax on cigarettes. Calculation of the true net negative externalities associated with smoking is a difficult challenge. Even for those for which there is consensus about what should be included and what should not, estimates of the magnitude of social externalities vary widely [see e.g., Manning *et al.* (1989), Hay (1991), Hodgson (1992), Barendregt and Olekaln (1998), Viscusi (1995), Warner el al. (1999)].

Health problems associated with alcohol abuse include both acute and chronic effects (see Cook and Moore, 2000). Short-term problems include injuries sustained in traffic accidents, industrial accidents, drowning, and alcohol overdose, decreases in productivity at work, as well as domestic and other violence. The long-term consequences include damage to the liver and other organs, impaired cognition and immune system function, and alcohol dependence. Drinking during pregnancy may cause persistent abnormalities in physical and cognitive development of the child. However, the health consequences of drinking alcohol are not entirely negative: for example moderate drinking may even protect against coronary heart disease.

2.2.3. *Merit goods, paternalism and addiction*

An added complication in determining what is the optimal level of taxation of alcohol and tobacco is that the principle of corrective Pigouvian taxation has to be extended to account for the presumed underestimation of the personal cost of drinking and smoking. If consumers tend to disregard certain costly consequences of their consumption, then it is possible that tax increase would bring their consumption level closer into line with their «true» pref-

erences. The reality is that alcohol and tobacco consumption are addictive, that they are habits that are often initiated at young ages, and that many consumers are not truly well informed about the real and potential hazards. This challenges basic precepts of rational behaviour (see Laux, 2000).

Merit/demerit goods are those whose consumption is considered to be of social merit or demerit, to a degree exceeding consumers' own valuations. Is it very difficult to construct economic arguments for pure merit/demerit goods, and this leaves the concept of these goods as a reflection of paternalism. As explained in Elleman-Jensen (1991), it is difficult to deny that paternalistic attitudes seem to be present in actual policies towards addictive goods.

Alcohol and tobacco could be considered as demerit goods, and diminishing their consumption would lead to a potential increase in health, which is often regarded as a merit good. If the public sector acts paternalistically it would try to provide a minimum level of health for those that are not aware of its importance, and would also try to diminish patterns of consumption which put health at risk. Excise taxes have the potential for achieving this objective.

2.2.4. *Equity*

Until now, we have described only the efficiency objective. Nevertheless the search for an optimal tax encompasses consideration of efficiency and equity, so we present here some issues related to equity that are relevant for the design of a policy of taxation on addictive goods.

Economists have analysed vertical equity, that is, how differently should be taxed those who are essentially different. Norms of vertical equity typically imply a preference for proportionality or progressivity, when the «ability to pay» principle underlies taxation. But excise taxes on alcohol and tobacco are regressive with respect to income (the usual measure of ability to pay), if poorer and more affluent consumers smoke and drink at the same rate. The regressivity is exacerbated if the prevalence is inversely related to income. This is the case for tobacco in many developed countries. The degree of progressivity or regressivity of different sources of health care funding is illustrated in table 1, where positive values of the Kakwani index indicate a progressive source of funding and negative values indicate a regressive source. These show that in practice indirect taxes are regressive and direct taxes tend to be progressive.

There is an equity justification for imposing a tax on drinkers or smokers if the «benefit principle» is taken into account. This principle maintains that those who receive greater benefits from government activities should be taxed more heavily than those that benefit less, and it could justify an imposition of a «user fee» which charges for the negative externalities generated. Given the harmful effects associated with drinking and smoking presented above, it is clear that alcohol and tobacco users are more likely to suffer morbidity and disability, and claim a disproportionate share on government expenditures on medical care and disabil-

Table 1
Kakwani indices - by country & source

	Direct taxes	Indirect taxes	General taxes	Social insurance	Total public	Private insurance	Direct payments	Total private	Total payments
Denmark (1980)	0.0624	–0.1126	0.0372		0.0372	0.0313	–0.2654	–0.2363	–0.0047
Finland (1990)	0.1272	–0.0969	0.0555	0.0937	0.0604	0.0000	–0.2419	–0.2419	0.0181
France (1989)				0.1112	0.1112	–0.1956	–0.3396	–0.3054	0.0012
Germany (1989)	0.2488	–0.0922	0.1100	–0.0977	–0.0533	0.1219	–0.0963	–0.0067	–0.0452
Ireland (1987)	0.2666	n.a.	n.a.	0.1263	n.a.	–0.0210	–0.1472	–0.0965	n.a.
Italy (1991)	0.1554	–0.1135	0.0343	0.1072	0.0712	0.1705	–0.0807	–0.0612	0.0413
Netherlands (1992)	0.2003	–0.0885	0.0714	–0.1286	–0.1003	0.0833	–0.0377	0.0434	–0.0703
Portugal (1990)	0.2180	–0.0347	0.0601	0.1845	0.0723	0.1371	–0.2424	–0.2287	–0.0445
Spain (1990)	0.2125	–0.1533	0.0486	0.0615	0.0509	–0.0224	–0.1801	–0.1627	0.0004
Sweden (1990)	0.0529	–0.0827	0.0371	0.0100	0.0100		–0.2402	–0.2402	–0.0158
Switzerland (1992)	0.2055	–0.0722	0.1590	0.0551	0.1389	–0.2548	–0.3619	–0.2945	–0.1402
UK (1993)	0.2843	–0.1522	0.0456	0.1867	0.0792	0.0766	–0.2229	–0.0919	0.0518
USA (1987)	0.2104	–0.0674	0.1487	0.0181	0.1060	–0.2374	–0.3874	–0.3168	–0.1303

Source: Wagstaff *et al.* (1999).

ity payments, however this is offset by reduced claims on pensions and other expenditures due to lower average life expectancies.

The «ability to pay» and «benefit» principles lead to different conclusions. According to the first, heavy drinkers or smokers should not pay more taxes if they are the poorer but according to the second, they should finance the health care costs that they generate with their patterns of consumption. Equity principles are subjective, and depend on the general opinion that is dominant in every moment and country. Nowadays, it is widely accepted that equity in health care funding is achieved through the ability to pay principle. The ability to pay principle seems to be quite a good way of design a funding health care system if we consider that public health care is based on risk sharing and also that one of the public sector objectives is redistribution of income. A private health insurance company may legitimately charge more to a person whose behaviour is high risk (compared to another one who presents less risk) even if the risky one is poor and the non risky is rich. But this attitude may be more difficult to accept for voters if a politician would propose it. This is because the public sector should not necessarily pursue «benefit maximization» as their first objective in the agenda. If this view is not accepted, and risk (but not redistribution of income) is what determines who should pay more, not only smokers or drinkers, but also old people or those who present chronic illness (often situated in the left side of income distribution) should contribute more. Although attitudes may differ to the extent that these risks are perceived to be within the individual's own control.

2.3. Should the two be linked: is there a role for «sin taxes» in financing health care?

The benefit principle suggests that the cost of a public service should be borne by those that benefit from it. Health care funding would need tax bases that are as broad as possible if hypothecated taxes are to be applied, because everybody (if health care benefits are universal) is covered. That is, smokers and drinkers are just a sub-group among all the potential users of health care. If health care was funded *only* using the revenue of sin taxes, sufficiency could not be achieved. On the other hand, if the rule for getting resources for funding health care is that those who generate a cost would pay for it (benefit principle), then, it would be fair to exert a sin tax for being ill or elderly. These «sinners» are usually the worse off, what would contradict the ability to pay principle. Taxes on these goods, are likely to be regressive. The tax base is narrow and hence prone to volatility, and in the case of tobacco, the real value of tax base is in decline. Sin taxes tie the funding of health care to unhealthy activities, creating the perverse incentive that smokers or drinkers who want more spent on health should consume more alcohol or tobacco.

The preceding arguments do not rule out the use of tobacco and alcohol taxes to pursue public health objectives, as stated in Jones and Duncan (1995). The discussion presented in Stoddart *et al.* (1986), in a study of the possible financial externality that smokers could impose on non-smokers in Canada through their health care utilisation, highlights some interesting ideas. They point out that the design of tax policies depends critically upon the assumed policy objectives. If the objective is the improvement of population health (measured for instance using an average index), higher taxes are warranted. This policy position may be supported on several grounds, including first, that the social cost of addictive goods exceeds the social benefit in total, second, the observation that many addicts are unable to realise their stated preferences to give up addictive consumption, and third that many non-consumers of alcohol and tobacco care about the health of those who consume. If sin taxes are motivated by a desire to correct the financial externalities that addicts impose on those who do not consume alcohol and tobacco, it is important to check if this uncompensated externality exists [7].

It is evident that sin taxes could play an important role in discouraging addictive consumption [8], and they could lead to a reduction of health costs generated for smokers and drinkers, and reduce efficiency costs. In reducing prevalence and consumption of harmful goods, there are also gains in terms of efficiency since sin taxes discourage decisions that involve creation of externalities. It also obvious that taxation on alcohol and tobacco increases government revenue. What is not so clear is that health care costs should be funded by the revenue obtained from addicts. This is due to several reasons: addictive goods are consumed by a minority, and health care is provided for all, and sin taxes do not offer a broad tax base and could generate equity problems since they are regressive.

3. Economic approaches to addiction

Kuhn *et al.* (1998) offer the following definition; «addiction is the repetitive, compulsive use of a substance that occurs despite negative consequences of use». Following Kuhn *et al.* (1998) addiction can be characterised by three basic dimensions. 1) Tolerance, that means the gradual adaptation of consumers to larger amounts of the addictive good, corresponding to the disappearance of the negative side effects that people experience when they start the consumption. 2) Withdrawal, associated with the irreversibility of the consumption, since the more is consumed the more difficult it is to stop the consumption. As the body adapts to taking a drug, this can be counterproductive when consumption stops. 3) Reinforcement, refers to the positive effects of habits, since a reinforcer is something that motivates the individual to work towards getting more. So, the experience of consumption makes the user willing to make sacrifices to repeat the experience.

Economic models of addiction can be divided in three basic groups [9]:

- the conventional model of consumer behaviour, which ignores addiction,
- myopic models of addictive behaviour which do not take into account the future consequences of current consumption, and
- rational models of addictive behaviour (assuming time consistency or inconsistency), which consider the future consequences of present consumption.

The fact that future consequences are taken into account does not mean that consumers enjoy perfect foresight. Pashardes (1986) for instance, developed a model in which perfect foresight and myopia are both nested as special cases. Orphanides and Zervos (1995) proposed an extension of the rational addiction model in which individuals are uncertain about their own tendency for harmful addiction, and as they experiment with the drug, they can regret their decision. In another extension Orphanides and Zervos (1998) consumers become more myopic as the consumption of the addictive good increases.

In the rational addiction model, pioneered by Becker and Murphy (1988), consumers take account of future effects of current consumption. In this context, individuals incorporate the interdependence between past, current and future consumption in their decisions. Consequently, the long-run effect of a permanent change in price will exceed the short-run effect. The short run elasticity holds past consumption constant, so, it must be smaller than the long run price elasticity, which allows past consumption to vary [10]. Myopic models also predict this result, but in rational models, the ratio of the long-run to short-run price effect increases as the degree of addiction rises. The intuition of this result is that since past consumption reinforces current consumption, the price response grows over time in the case of an addictive good. If the price rises in year one, consumption in that period will be reduced, but consumption in year one causes consumption in year two, three, and successive years, and the long-run price response is greater the higher level of addiction.

Addicts with higher discount rates (future costs and benefits are less important to someone the higher is their rate of discount) will be relatively more responsive to changes in

prices than those with lower discount rates. The interactions between time preference and addiction can be illustrated using two ideas. First, people who discount the future more heavily are more likely to become addicted. Second, harmful addictions induce even rational persons to discount the future more heavily, which in turn leads them to become more addicted. In the Becker and Murphy model, it is also predicted that the effect of an anticipated change in price will be greater than an unanticipated one, while a permanent change in prices will have larger effect than a temporary one. This is a way of introducing uncertainty, nevertheless, one of the recurrent criticisms of this model is the assumption of perfect foresight and the way it ignores the role of uncertainty. Orphanides and Zervos (1995) relax this assumption by assuming that inexperienced users are uncertain of their own propensity to become addicted.

More recently Goldbaum (2000) demonstrates that the desire to quit smoking can be the outcome of a rational consumption path of a harmful and addictive good chosen at the time that the consumer began smoking. The consumer accounts for the future health consequences of smoking and the withdrawal cost of quitting. A consumer's preferences dictates if he smokes or abstains, and if he smokes whether he is content or dissatisfied with his addiction for the majority of time that he smokes.

Laux (2000) has attempted to draw out the policy implications of the rational addiction literature. His argument is that addiction creates a form of «internality». Many people adopt their addictive behaviours before the age at which society regards them as sovereign and responsible for their own decisions (be that 16, 18 or 21). The rational addiction literature shows that this history of early consumption spills over into adult consumption patterns. Hence this provides a rationale for public policy intervention to prevent consumption.

The traditional analysis in the context of a rational addiction has been extended in Gruber and Koszegi (2002) by considering time inconsistency about addictive consumption. In the rational addiction framework of Becker and Murphy model, individuals recognise the full price of addictive consumption (current monetary price plus cost in terms of future harm and addiction), but time consistency [11] is assumed. Gruber and Koszegi (2002) state that *«there is no evidence, psychological or other, that supports time consistent preferences over inconsistent ones»* and also *«There is an empirical literature which presumes to test the rational addiction model by documenting forward looking behaviour by consumers (...) this literature tests one premise of the Becker and Murphy model, showing that smokers are not fully myopic, but not the second premise, time consistency».* These authors show some evidence sustaining time inconsistency in smoking behaviour, for instance laboratory experiments, calibration of real world behaviour against models with and without time inconsistency, and an economic test by Gruber and Mullainathan (2001).

There are at least other two recent models which suggest time inconsistency as a better assumption for modelling addiction. In Bernheim and Rangel (2001) the agent is located in the «visceral» state when overconsumes the drug and price sensitiveness disappears. The model of Gul and Pesendorfer (forthcoming, 2000) is driven by disutility from temptation,

assuming that the agent is tempted equally strongly by the drug for all possible prices (if her or his wealth is enough to pay for it).

The standard approach for modelling rational addiction through the Becker and Murphy model rely on the assumption that individuals are appropriately forecasting prices far in advance. As Gruber and Koszegi (2001) highlight, for cigarettes at least, very few price increases are announced this far in advance. But the traditional model of addiction has a more fundamental theoretical problem: forward looking behaviour does not imply time consistency, and time consistency is a key assumption of the rational addiction framework. Adda and Lechene (2001) describe situations in which the standard version of the rational addiction model does not fit the empirical evidence. For example: the standard model is not able to generate hump-shaped life cycle profiles if two stocks are not considered. This is exactly what Adda and Lechene (2001) did, including one stock for addiction and one for mortality. This also solves the problem of exogenous quitting (in the traditional model only exogenous shocks could lead the agent to stop smoking, but the evidence shows that a number of smokers do quit even when prices are stable). Adda and Lechene (2001) explore the relation between potential life expectancy and smoking profiles; their model shows that individuals with longer potential life expectancies are smoking fewer quantities and smoking earlier [12]. When they condition on other characteristics capturing risky behaviour (such as marital status, number of children, taxable wealth and household income), the effect of life expectancy on smoking is still significant.

4. Empirical evidence on the effectiveness of taxes

The models of consumer demand summarised above, have been applied in empirical research to determine how consumers respond to certain policies designed to fight against harmful consumption. These control policies include advertising restrictions, the dissemination of information on the health consequences of harmful substances, restrictions on consumption in public and work places, and limits on youth access to these products. But, in this section, our interest is focused on the impact of taxation on alcohol and tobacco demand. Several dimensions of demand can be analysed, such as:

- the overall level of consumption,
- the prevalence of the habits and decisions to initiate and quit,
- how responses vary among groups with different characteristics (especially young people),
- the effects of taxes on smuggling and cross-border shopping, and
- the impact of taxes on the adverse consequences of addiction.

The empirical evidence is more profuse for tobacco than for alcohol. One possible explanation could be that researchers are aware that measurement error problems become particularly acute in the microeconomic literature of alcohol demand. The use of macro

data is not exempt from problems either [13]. As stated in Ruhm (2000) —who investigates the relationship between macroeconomic conditions and liquor consumption and highway vehicle fatalities—, the use of microdata has the advantage of allowing for more fully specified models but can introduce other problems. The comparison of results from studies which use macro and micro data can lead to different results. An example of this can be viewed in Ruhm (1995) and Freeman (1999), which confirmed that alcohol consumption moves pro-cyclically. On the other hand, Thomas (2001) concluded that the stress from anxiety over being unemployed in a period of recession raises the levels of alcohol consumption.

Tobacco and alcohol are usually taxed more than once, that is, apart from value added tax, there are also excise taxes. Given the addictive character of these goods, excise taxation offers a special attraction for legislators. Alcohol, cigarettes and other tobacco products have been taxed for centuries. Firstly, motivated by demand inelasticity, and in more recent times by the intention to reduce consumption. There is widespread acceptance that these goods should be taxed more heavily than other commodities, and the justifications have been discussed in Section 2. Nevertheless, there is not a unique level of optimal taxation, since it depends on the circumstances, policy objectives and the priority among them. The level of taxation on alcohol and tobacco varies widely across countries —which has generated a difficult harmonisation issue in the European Union. Since harmful addictions are sensitive to price these behaviours can be discouraged by taxation.

4.1. Level of consumption

Depending on the available data, the analysis of demand of addictive goods can be more or less ambitious. At the aggregate-level it is more difficult to study the effect of prices on the probability of participation (decisions over starting or quitting), and on average consumption among consumers. Nevertheless aggregate data permit analysts to obtain the effect of prices on total or per capita cigarette consumption, the proportion of smokers and/or drinkers (by homogeneous groups) and the probability of participation by these groups [see for instance Jones (1989), Jiménez and Labeaga (1989) and López (1998)].

Price elasticity estimates of cigarette demand using aggregate data, have been obtained in numerous economic studies on the past three decades (see Chaloupka and Warner, 2000, for a full review, we present a synthesis of their findings). The values range from –0.1 to –1.3, with a majority within a narrower range of –0.3 to –0.5. This variability in the results can be explained by the use of different data, theoretical models and estimation techniques. These studies examine the effects of price on cigarette demand controlling for relevant factors such as income, demographic and socio-economic characteristics, or the existence of tobacco control policies. The responsiveness of addictive goods to changes in prices [14] demonstrates that the idea that addictive behaviour is irrational and is not suitable for conventional economic analysis is not correct.

When the analysis of the effect of prices on consumption of addictive good is focused on drinking, it is interesting to concentrate on heavy drinking. It is a widespread presumption that alcoholics will do whatever is necessary to maintain their drinking at a high level, including substituting cheaper sources of alcohol or cutting back on other living expenses. In particular, an increase in excise tax would likely make their lives more difficult, since they would consume less quality, but it not cause them to cut back. The evidence, however, suggests that this image is not entirely correct. Manning *et al.* (1995) analyse how the price elasticity changes with drinking level. They find that, among those who report drinking, the estimated price elasticity follows a U shaped pattern with respect to relative consumption. At the highest level of consumption (95 % percentile), the estimated elasticity is slightly positive. This confirms the conventional wisdom that heavy drinkers will find a way to maintain their drinking in the face of modest changes in prices. The apparent contradiction with this result and other findings has not been explained.

In econometric terms, tobacco and alcohol cannot be modelled in the same way since the reasons why zero observations appear could not be the same. A discussion on this subject is showed in Jimenez and Labeaga (1994), where the possible explanations why zero expenditure could arise are: infrequency of purchase, non-participation in the good at any given value of prices and income, households maximizing utility at zero consumption for their current budget (corner solutions) or misreporting given the nature of the analysed goods. Using the simplest approach (Tobit model) does not distinguish between zeros arising by economic conditions and non economic decisions, but an extended model by Cragg (1971) discriminates between these two different reasons for observing zeros.

4.2. Prevalence-initiation/cessation

Studies employing aggregate data are typically unable to evaluate the different impact of prices among groups, nor can they differentiate between the impact of price on prevalence and quantity, or initiation and cessation. A few analyses have attempted to address these limitations. Jones (1989) finds no evidence of a significant price effect on the prevalence of smoking in aggregate data for the UK. Harris (1994) using data from the period 1964-1993 in USA, estimates that approximately half of the effect of price was on smoking prevalence, with an elasticity of smoking participation of –0.24 while the unconditional price elasticity of demand was –0.47.

Using micro-data presents other kinds of problems, associated with inaccurate measures of consumption, or failing to account for differences in prices. These may produce biased estimates of the elasticity of demand. The use of longitudinal data to examine the impact of tax and price changes on initiation and cessation, is an important advance, and the lack of appropriate data explains that studies of initiation and cessation of smoking have been neglected until recently, while other aspects of smoking have been a matter of concern for at least 30 years. Determining why people start smoking and what factors cause smoking duration should be a central focus in formulating appropriate anti-smoking policies.

Douglas (1998) in the context of a rational addiction model, concluded that current, past and future prices of cigarettes have a statistically insignificant effect on the probability of initiation, and that current and past prices are insignificant in the probability of quitting. However, his results suggest that increases in future cigarette prices will significantly increase quitting rates. The estimated elasticities mean that a 10 % permanent increase in the future price of cigarettes will reduce the average duration of smoking by 11-13 %. One possible explanation why current and past price effects are found to be insignificant may be due to the fact that he uses one year cross-sectional data, then incorrect recall by participants can dramatically influence any results obtained. Paradoxically, past and current prices are not significant in the analysis of cessation and the hazard of smoking cessation has a positive duration dependence, what Douglas suggests is consistent with rational addiction in that the rational smoker will discount future health costs less as they become more imminent.

Forster and Jones (2001) use retrospective information on cigarette smoking for Britain to approximate the length of time each individual smokes and abstains from smoking. They find that cigarette taxes were insignificant for determining initiation of smoking, and the estimated elasticity of the number of years smoked before quitting with respect to tax falls in a range of –0.40 to –0.63, suggesting that a 5 % increase in tax would lead to a reduction in smoking of approximately 6 to 9.5 months.

Using Spanish data, López (2002) studied the importance of tobacco price in the propensity to start and quit smoking, and found that prices have a very small effect on the propensity to start smoking, and only the price of black [15] cigarettes appears to be significant to explain the hazard of quitting.

Manning *et al.* (1995) used data from the US National Health Interview Survey to study alcohol responses to price, and found that decision to drink is responsive to the price level.

4.3. Youth smoking and drinking

Young people's responsiveness to prices has been a matter of concern in the study of addictive consumption. One reason why it is interesting to know what happens with youth could be that a young person has a longer life expectancy, so, preventing them from consumption could lead to greater potential gains compared with older people.

When the effect of prices on the level of consumption of tobacco among young people is estimated, the conclusion appears to be remarkably consistent [16]: youths are more price sensitive than adults. Some evidence of this higher responsiveness is shown in tables 2 and 3, where elasticities of alcohol and tobacco are presented. This could be explained by several reasons. Given the addictive nature of smoking, long-term adult smokers are likely to adjust less quickly to changes in price than youths, who due to their age, have been smoking relatively less time. Peer behaviour is, in addition, likely to be much more influential at younger ages. Taking income into account, the fraction of disposable income that young

Table 2
Reported elasticities for smoking

AGGREGATED DATA			
Keeler *et al.* (1996), Baltagi and Levin (1986), USA	Cigarette consumption		Around –0,4
Baltagi and Goel (1987, USA)	Cigarette consumption		(–0.17, –0.56)
Harris (1994) USA from 1964 to 1993	Consumption (unconditional) Participation		–0.47 –0.238
INDIVIDUAL LEVEL DATA			
Lewit *et al.* (1981), USA	Price elasticity, conditioned to participation Participation		–0.46 –0.26
Lewit and Coate (1982), USA	Price, conditioned Participation	Young aged 20-25	–0.74 –0.2
	Price, conditioned Participation	Teenager aged 12-17	 –1.20
Wasserman *et al.* (1991), USA	Total elasticity Over time (1970 to 1985)		–0.283 –0.06 to –0.23
Yurekly and Zhang (2000), Columbia	Over time (1970 to 1995)		–0.48 to –0,62
Chaloupka and Wechsler (1996), USA college students	Participation Price, conditioned		–0.53 –1.11
Farrelly and Bray (1998), USA	Young aged 18-24 (total elasticity) Full sample (total elasticity)		–0.58 –0.25
Hsieh *et al.* (1999), Taiwan	Price elasticities (domestic) Price elasticities (imported)		–0.6 –1.1
INITIATION AND CESSATION			
Forster and Jones (2001), United Kingdom	Quitting	Men Women	–0.60 –0.46
López (2001), Spain	Starting		0.07
	Quitting	Men	–1.3
		Women	–1.5

Source: Summary from references.

smokers spend on cigarettes may exceed that spent by adult smokers. In the context of addictive behaviour, predicted changes in prices will have a greater effect on those with higher discount rates since they give less importance to the future consequences of present consumption of the addictive good.

Table 3
Reported price elasticities for alcohol consumption/participation

Saffer and Dave (2002)	Pooled time series. 20 countries, 26 years	–0.19			Average alcohol price elasticity	
Angulo *et al.* (2001)	1990-91, Spain	Overall	Participation	Conditional		
		–1.52	–0.48	–1.04	Wine	
		–2.44	–1.27	–1.17	Beer	
		–4.65	–3.61	–1.04	Spirits	
		–2.99	–2.34	–0.65	Cava	
Bieliñska and Young (2001)	Pooled data USA (1982-97)	Range (–0.53, –1.24)			Alcohol price elasticity	
Mayo (2000)	Pooled time series in 4 regions USA	–2.9			Alcohol price elasticity	
Smith (1999)	UK (1993-96)	–0.76			Beer	
		–1.69			Wine	
		–0.86			Spirits	
Grossman *et al.* (1998)	USA	–0.29			Ignoring addiction	
		–0.41			Accounting for addiction	Short run
		–0.65				Long run
Clements *et al.* (1997)	Nordic countries, Canada, UK, Australia and New Zealand	–0.35			Beer	
		–0.68			Wine	
		–0.98			Spirits	
Nelson (1997)	USA	–0.16			Beer	
		–0.58			Wine	
		–0.52			Spirits	
Manning *et al.* (1995)	USA data for 1983	Heavy drinkers less responsive than light or moderate drinkers				
Kenkel (1993)		–0.92			All young	
		–2.24			18-21 years old	
		–0.74			Participation	Men
		–0.81				Women
Leung and Phelps (1993)	Review of 15 studies	–0.3			Beer	
		–1			Wine	
		–1.5			Spirits	

Source: Summary from references.

From the earliest studies focused on responsiveness of youths [See Lewit *et al.* (1981)], to the most recent ones, for example, Tauras and Chaloupka (1999), some interesting results can be highlighted. In general terms, it appears that price sensitivity of cigarette demand is inversely related to age, the price elasticity of smoking participation is about half the unconditional price elasticity of demand for college students, the demand elasticity for young people of ages 18 to 24 is more than twice the elasticity of adults, and youth smoking has become more price sensitive over time. Lewit *et al.* (1981) and Lewit

and Coate (1982) examine the effects of price on cigarette smoking, estimating an overall price elasticity of demand of –0.42, and an elasticity of participation of –0.26. They found an inverse relationship between price elasticity and age, since the total price elasticity of demand for young people between 20 and 25, more than double that of persons of 26 and over. These results are maintained in more recent studies that use different data surveys, as in Wasserman *et al.* (1991), Chaloupka and Grossman (1996) or Farrelly and Bray (1998).

In general, researches examining the effect of price on smoking participation using individual data from cross-sectional surveys, have assumed that much of the effect estimated for youth reflects the effect the impact of price on smoking initiation, while the estimate for adults is capturing the effects of price on smoking cessation. But empirical studies of initiation contradict this finding. Douglas and Hariharan (1994) used retrospective data for estimating a hazard model, concluding that socieconomic and demographic factors had a significant effect on smoking initiation, whereas their estimates for prices were insignificant. Nevertheless, Dee and Evans (1998) estimate a significant impact of cigarette taxes on smoking initiation (they obtained a price elasticity of –0.63).

Much of the econometric literature on alcohol abuse, has been focused on young people. This is understandable: young people have high rates of binge drinking and are more likely to be involved in traffic accidents and violent crime. To the extent that drinking is habit forming, youthful drinking sets the pattern for later consumption and have long-term consequences. A number of studies using different data sets suggest that the frequency of youth drinking and bingeing are both importantly related to price. An exception to this pattern has been found by Chaloupka and Wechsler (1996), who analysed drinking by college students and found that the price of beer has no discernible effect on drinking practices of male students. A possible explanation is that much of their alcohol consumption is in group settings where individuals do not pay by the drink.

4.4. Heterogeneity in responses to price

As it was pointed out in section 4.1, the existence of micro-level data permits deeper analysis than macro-level data. One of the advantages of micro-level information, is that it can be used to evaluate the differential effects of price on different demographic groups [17]. It is possible to find some work using aggregate data for the study of the differential effects of price on cigarette smoking for various population subgroups, as in Townsend *et al.* (1994). With British data covering the period 1972-1990, they found women more responsive than men, and lower socio-economic groups were more sensitive to prices than those that were better off. They also conclude that the age group between 16 and 24 years, was less responsive to price than adults. This last conclusion is just the opposite that is often obtained in other studies. Wasserman *et al.* (1991) found the price elasticity of demand in adults to be unstable over time, ranging from –0.06 in 1970 to –0.23 in 1985, and the results for teenagers do not appear to differ statistically from the estimates for adults.

When the study of the effect of responsiveness among different groups is conducted using micro-data, there are some recurrent effects that appear in different studies. Apart from the effect of age, that has been discussed above, analysis by gender suggests that men (particularly young men), are more responsive to price, while women are generally less responsive. Historical differences in patterns of smoking exist between men and women, and while the prevalence rates for men increased dramatically during the first decades of the twentieth century, rates among women did not begin to rise rapidly until some decades later. From 1965, smoking among both sexes has declined, but the rate of decline has been slower among women than among men. In Spain, for example, smoking prevalence among women increased from 17 % in 1970 to 27 % in 1990 whereas the male figure descend from 65 % to 45 % in the same period (López, 2002). This justifies the analysis of models with include gender as a relevant explanatory variable. Using data for the USA, Hersch (2000) estimates price elasticities for smoking participation and quantity of cigarettes in a rank between –0.4 and –0.6 for men and women.

Farrelly *et al.* (1998) found in that, in the USA, blacks seem to be twice as responsive as whites to cigarette prices, while Hispanics were even more price sensitive. They also estimated that individuals with family incomes below the median were about 70 % more responsive than those higher in the income distribution. In a later study, Farrelly *et al.* (2001) they confirm the bigger response to prices of young adults, African-Americans, Hispanics and women.

In order to summarise some of the elasticities of consumption, participation, initiation and cessation of smoking that have been reported in a selection different studies, we present a summary in table 2. The elasticities for smoking show again that there exists heterogeneity in the responses according to countries, sex, age, kind of product and also between participation and consumption. The price elasticities of participation are smaller than consumption conditioned to participation (referred as «price, conditioned» in table 2). Price elasticities for a selection of studies of alcohol consumption are reported in table 3. These data show that price elasticities are smaller for beer compared with wine or spirits [except for the Spanish case reported by Angulo *et al.* (2001)]. When young people [Kenkel (1993)] or heavy drinkers [Manning *et al.* (1995)] are separated from the rest of population, there is confirmation of their higher responsiveness.

4.5. Smuggling and cross-border shopping

The fact that taxation and retail prices vary across countries creates as a consequence casual and organised smuggling and other forms of tax evasion (see Chaloupka and Warner, 2000). One example of the link between cigarette tax increases and smuggling, is the Canadian experience during the late 80's and early 90's. The large tax and price disparities between Canada and USA led to substantial smuggling from the USA. What started as a minor problem, became more important in 1992 [see Sweanor and Martial (1994)]. Joossens and Raw (1995, 2000) reported little evidence of cigarette smuggling in some of the highest

priced European countries (France, Norway, Sweden and the UK), while there is extensive evidence in those countries with relative low prices as Spain or Italy. This seems conter-intuitive, since the higher is the price, the bigger is the potential willingness to buy smuggled products. In fact —as Joossens and Raw (2000) stated— smuggling occurs in all parts of the world, even in regions where taxes are low. Maybe, this is also a question of culture and responsibility. Crawford *et al.* (1999) analyse whether the loss in tax revenue due a cross border shopping of alcohol could be recouped by cutting excise duties. They use British data, from 1978 to 1996, estimating elasticities of wine, beer and spirits before and after the completion of the Single Market. They did not find evidence of a significant change in elasticities after the Single Market.

One internal document of BAT (British American Tobacco) estimated that nearly 6 % (318 billions) of world cigarettes sales were DNP «duty not paid». Eastern Europe and the Asia-Pacific region accounted for most of this (about 85 billion each), although Western Europe was also important at about 50 billion. The distribution of DNP cigarettes is about 13 % in Eastern Europe, 12 % in Africa and Middle East, 9 % in Latin America, and Western Europe, about 7 % (having the largest prices in the world). Tobacco industry has lobbied governments to reduce tobacco tax arguing that this will solve the smuggling problem and increase government revenues. The Canadian evidence quoted above shows that this is not true [Joossens and Raw (2000)].

4.6. Knock-on effects on health, employment, earnings, crime etc.

The effects generated by addiction to alcohol and tobacco are not the same. There is overwhelming evidence that smoking has detrimental health effects. The consumption of alcohol is different and more complex. Unlike cigarettes, many people regularly consume small quantities of alcohol, and this may not mean that they harm themselves or others. The health consequences of alcohol consumption are not all bad. Evidence suggests, for example, that moderate drinking may protect against coronary heart disease, or that alcoholic drinks offer a germ-free alternative in places where the only available water for drinking is contaminated [Vallee (1998)].

Excessive alcohol consumption generates other problems apart from health consequences. Examples include drunk-driving crashes, workplace accidents, violent behaviour, crime and suicide, child abuse, and failure to complete college or high school. A change in the price of alcohol due to taxes, can modify this negative effects, as has been found in several studies, and there is large evidence showing that consequences of alcohol misuse fall as the cost of alcohol rises. Some studies show that per capita alcohol consumption has a significantly positive effect on rape, assault, and robbery, and negligible effect on criminal homicide rates (see Cook and Moore, 2000). Increases of beer rates seem to exert a significant reduction in the likelihood of violent behaviour. Kenkel (1993) reports a strong positive association between heavy drinking by youths and the reported number of occasions of drunk driving [18], what provides a mechanism for the negative relationship between fatal mo-

tor vehicle crashes and the price of alcohol, since young drinkers (like young smokers) are quite sensitive to prices. Kenkel concludes also that increases in price and health knowledge reduce the prevalence of binge drinking. Cook and Tauchen (1982) report that a one-dollar increase in the state excise tax on distilled spirits lowers the age adjusted cirrhosis mortality rate by approximately the same percentage as it lowers per capita consumption of distilled spirits. Saffer (1991) finds that the price elasticity of cirrhosis mortality is three times larger than the price elasticity of per capita alcohol consumption.

In Allebeck (2001) different patterns of alcohol consumption, beverage preferences and effects of consumption across European Union countries are shown. There is some shocking evidence, for instance, that although sales data from the Baltic republics suggest low levels of consumption compared to western Europe, alcohol related mortality is almost twice as high. In Hungary, official consumption levels are not very different from those in southern Europe, but the mortality from liver cirrhosis is around three times higher.

5. Discussion

Public policy needs a rationale. In theory, the market mechanism works well, and allows for an efficient allocation of resources. But in practice, there exist market failures, which would justify the implementation of public policies in order to solve these failures. Public policies attempt to achieve efficiency and equity, and the intervention has to be designed in a way that does not generate more equity and/or efficiency costs than they are designed to solve.

The role of the government when taxing addictive goods are different depending on the underlying model of addiction which is assumed. Following the Becker and Murphy (1988) model the normative implication is solely a function of the interpersonal externalities induced by the consumption of the addictive good. Since that consumption is governed by a rational choice, the fact that smokers impose enormous cost on themselves is irrelevant; it is only the costs they impose on others that give rise to a mandate for government action (Gruber and Koszegi, 2002). When time inconsistency is included in the model, the implications for government policy change radically, since government regulations provides a device that is valued by time inconsistent consumers. In this case, Gruber and Koszegi (2002) highlight two important points. First, the optimal tax on cigarettes, above and beyond externalities is at least $1 per pack, and quite likely much higher. Second, the traditional conclusion that cigarettes are regressive is reduced, and most likely reversed, once self-control benefits of taxes are accounted for. This conclusions lies on the authors' calibrations which show much higher price elasticities of lower income smokers.

This orientation offers a new vision and should be taken into account, but is sustained on the basis of time inconsistency of the agents. Despite Gruber and Mullainathan (2002) found consistent evidence for USA and Canada suggesting time inconsistent model of smoking as more appropriate, this is still a matter which has to be discussed. If the hypothesis of time inconsistency models is confirmed, taxation of addictive goods should be fully recommended,

since addictive consumers are better off by taxes (as a self-control device). This welfare conclusion is exactly the opposite obtained under time consistency, where taxes make addictive consumers worse off.

In the provision of health care and consumption and taxation of addictive goods, there are many justifications in equity and efficiency terms for government intervention. Solutions to these problems are not unique, and in a context with multiple inter-connections, seeking the best solution is not an easy task. The main normative question that has been addressed here is if there is a role for sin taxes in financing health care. Politicians may be interested in the answer, since they are finally the agents that decide what government does. On the basis that politicians ought to seek to improve social welfare, there are several points to be remarked. The first step should be to decide what is the objective to achieve. There are different concepts of equity we should keep in mind. Following the vertical equity notion the system should be progressive, but that does not means that every component of the system needs to be progressive, which would allow the use of sin taxes despite pursuing overall progressivity. Under the horizontal equity notion, the tax system tries to treat equally those in similar circumstances, but indirect taxation is based on the same treatment across products, not across products consumed by different groups. This means that the use of sin taxes cannot achieve this objective when alcohol and tobacco are consumed more by the worse off. More health care and more tax revenue do not present a trade-off if sin taxes are used, but this instrument contradicts equity principles from an «ability-to pay» point of view. It may not contradict equity principle from the alternative «benefit» point of view. There is general agreement about the convenience in the *use* of sin taxes, and identifying a particular tax introduces transparency into the finance of a service. But it is more contentious to claim that sin taxes are the resource on which health care should be financed. This is due to problems of insufficient revenue, perverse effects on those who «commit the sin» of smoking or drinking, and also because it would be against widely held equity principles. The problem of insufficient revenue could be exacerbated if prevalence and consumption of tobacco and alcohol decreases, but the revenue of sin taxes has to be conceived for funding only part of the total health costs. The only chances to earmark a single tax to wholly fund the health care are those taxes which generate an important share of tax revenue such as income tax or sales tax.

Notes

1. The existence of market failures arises as a consequence of harm to consumers or others. The harm generated to consumers themselves is due to lack of information, reasoning or forward looking capacity. Being responsible for this harm or not, the existence of a market failure provides a justification for public intervention.
2. The revenue of this tax is not destined to cure those «addicted to use the car», but to finance health and environmental policies. This can be viewed as an application of PPP (polluter's pay principle) since the consumers of hydrocarbons are imposing a negative externality on the general population, and they will be who contribute more to correct the effects by paying more taxes as they consume more.

3. The main source for funding public activity comes from tax revenue (the ratio of total tax revenue/GDP is around 40 % for OECD countries during the last decade. See http://www.oecd.org/pdf.M00035000/M00035065). So, when a tax system is designed, the revenue has to be sufficient for the Government to fulfil its tasks, that is, sufficiency is a desirable principle. In order to obtain a given amount of tax revenue, different patterns of taxation could be implemented. Since paying taxes generates a welfare cost must be considered. Apart from the monetary cost, tax payers face other indirect costs: understanding tax rules can be time consuming, and the simpler they are, the less are these costs. So simplicity is also desirable.

4. A complete shift to the price paid by consumers would also be possible if elasticity of demand were zero. The less responsive is an agent, the more is the capacity for tax shifting. For example, if demand is completely inelastic, consumers always choose the same amount of consumption, regardless of the price. In this case, producers know that if they raise the price, their benefits would increase, since sales are not decreased.

5. Income and substitution effects could be measured in income terms, even if the tax base is not income but consumption, using several money metric measures.

6. Coase (1960) supposed zero transaction costs, and this is not likely in the real world: the difficulty of finding an agreement becomes harder the larger the number of people involved. The problem is really due to transaction costs, not due to externalities, because if there were externalities but no transaction costs, parties would always bargain to the efficient solution.

7. They found that it was extremely unlikely that publicly financed health care expenditure attributable to smoking in Canada exceeded revenue from tobacco taxes.

8. The effect of sin taxes is not uniform for every country, every group of population, or every considered good (or bad). This can be checked by having a look at Tables 2 and 3, where information about alcohol and cigarettes elasticities is presented.

9. Portillo and Antoñanzas (2001) present a wide review of the economic literature on addiction, including a variety of theoretical models of addiction, the linkages among them and a critical evaluation on their feasibility to end up with empirical applications.

10. This property does not hold in general for a non-addictive good.

11. Under time consistency time intervals further away than ones closer to the present should be less pondered. That implies an increasing rate of discount along time.

12. They demonstrate that there is a negative correlation between potential life expectancy and smoking, but not a causality

13. Ruhm and Black (2002) investigate the relationship between macroeconomic conditions and drinking. The use of aggregate data introduces several complications because the set of covariates controlled for is generally limited. This can be solved using fixed-effects models. But there is also the «ecological inference problem» when it is difficult to ascertain individual behaviour, for instance overall alcohol consumption might fall during recession because of decreases among recreational use, even while heavy drinking increases.

14. Labeaga (1999) confirms that tobacco is an addictive good with very low price elasticities, concluding that prices are not a good instrument for reducing tobacco consumption, although consumers seem to behave rationally.

15. The study uses differences between price of black and blond cigarettes, and also includes a weighted measure of both

16. See Townsend *et al.* (1994) for an exception.

17. Some models provide elasticity values which are different from each individual in the sample. It is impossible to design a different treatment for every individual (her administrative factibility arises again), but it is a good thing to count on this information for grouping in the more convenient way for the policy maker.

18. The measure used by Kenkel is known as «binge drinking» defined as the number of days in the past year with five or more drinks.

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Resumen

En este trabajo presentamos un panorama sobre la evidencia empírica de la efectividad de los impuestos en la lucha contra los comportamientos adictivos, y planteamos la siguiente cuestión: ¿se deben utilizar en mayor medida los impuestos sobre el pecado para financiar el gasto sanitario? En primer lugar planteamos si es conveniente vincular la financiación sanitaria y el gravamen de bienes que generan adicción teniendo en cuenta eficiencia y equidad como principios básicos a la hora de evaluar políticas de ingreso y de gasto. En segundo lugar se presentan los distintos enfoques que los economistas han adoptado en el estudio de la adicción y sus implicaciones en términos de política. Al final, se resume la evidencia empírica relativa a la efectividad de los impuestos.

Palabras clave: Adicción, tabaco, alcohol, imposición consumos nocivos.

Clasificación JEL: I18, H21, H23, H51.